

# July 2022 NOAA Ship *Okeanos Explorer* EM 304 Multibeam Calibration Results

Supporting Document for the NOAA Ship *Okeanos Explorer* Mapping Systems Readiness Report  
2022 (<https://doi.org/10.25923/g2ep-ae34>)

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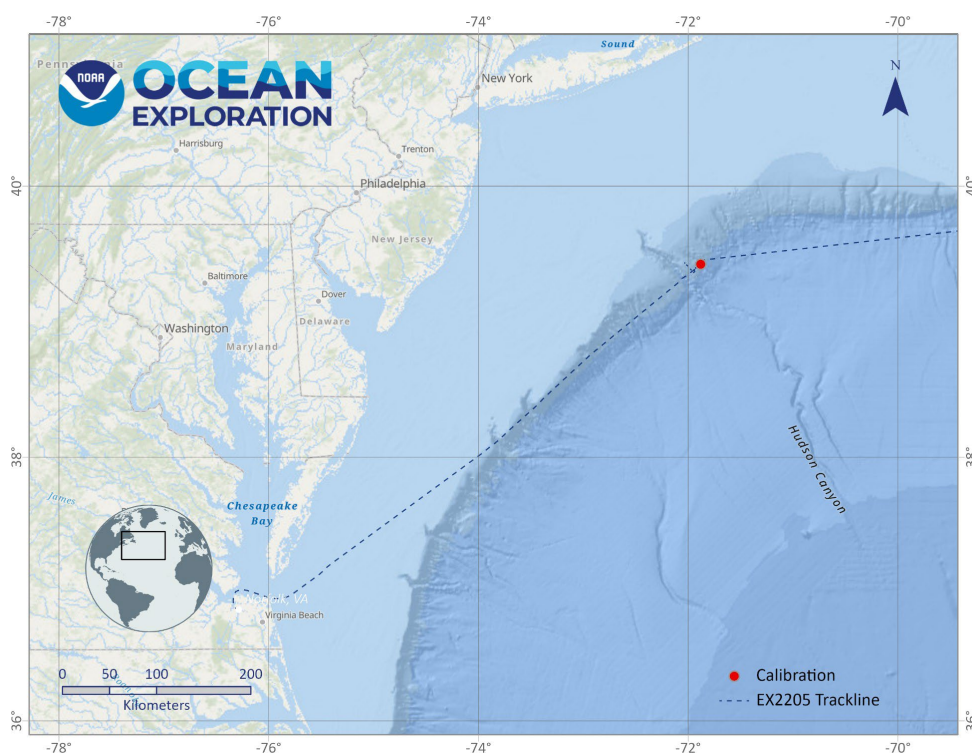
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## Overview

During EX-22-05, the Voyage to the Ridge 2 expedition, a multibeam geometric calibration ('patch test') was performed due to an emergency dry dock prior to the start of the expedition (**Figure 1**). A patch test should be performed following drydock to account for any changes in the alignment of the transducers (even if minuscule), which is a potential byproduct of the ship being placed on blocks. The offset values calculated during this patch test supersede those calculated during the EX-22-01 shakedown expedition (**Table 1** and **Table 2**).

For detailed information about all of the mapping equipment aboard NOAA Ship *Okeanos Explorer* and annual calibrations performed at the beginning of the field season, see the 2022 NOAA Ship *Okeanos Explorer* Mapping Systems Readiness Report,<sup>1</sup> to which this is a supporting document. Any future mid-season equipment calibrations or modifications will also be archived as a supporting document with the annual readiness report.



**Figure 1.** EX-22-05 EM 304 multibeam patch test location.

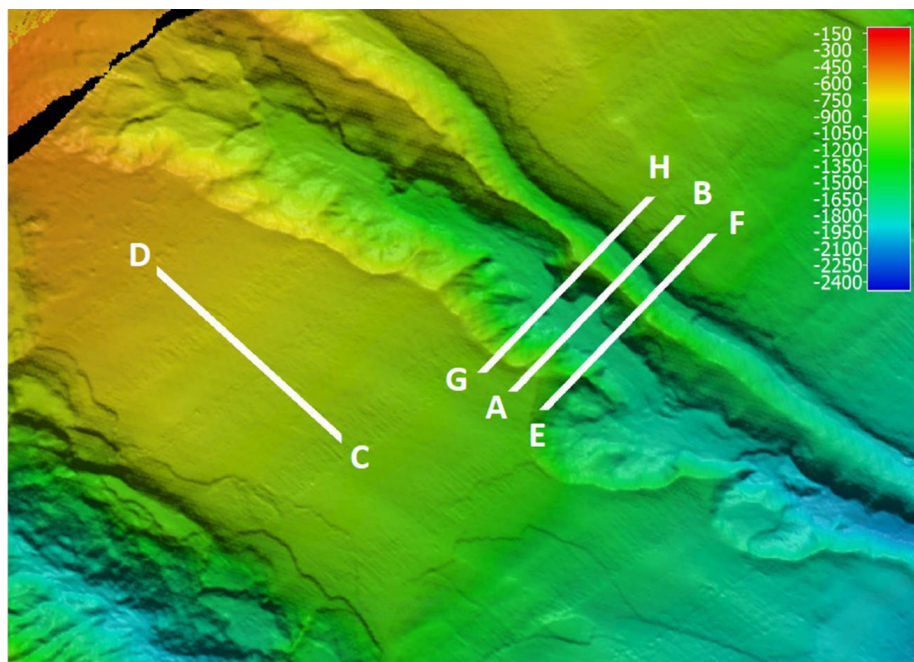
<sup>1</sup> <https://doi.org/10.25923/g2ep-ae34>

# Calibration Results

## EM 304 Patch Test

Following a successful GAMS calibration that confirmed no changes in the alignment of the POS MV antennas, a multibeam geometric calibration ('patch test') was conducted north of Hudson Canyon off the northeast coast of the United States on July 10, 2022 (**Figure 1**). The Applanix POS MV was set as the primary attitude and positioning system during the patch test. A secondary patch test was not performed with the Seapath set as the primary system, but angular offsets were calculated by post-processing the data with the Seapath set as the primary.

This site was originally selected based on the availability of seafloor features with optimal slopes and bathymetric relief along the expedition's planned transit. The same patch test site was used in 2018 following the replacement of the EM 302's receive array. The line plan was developed to follow the necessary order of calibration steps within the time constraints (**Figure 2**). Expendable bathythermographs (XBTs) were conducted prior to the first pitch, roll, and heading line sets; all sound speed profiles were processed in Sound Speed Manager and applied in Seafloor Information Systems (SIS). Calibration lines were run at 6 knots. Lines were analyzed using the QPS Qimera v2.4.9 Patch Test Tool. The patch test lines performed for each offset are further described below.



**Figure 2.** Overview of EM 304 patch test lines from EX-22-05 (depths in meters).

- **Pitch Offset** - The pitch bias was determined by running a single line in opposite directions at the same speed (Line A – B in **Figure 2**).
- **Roll Offset** - The roll bias was determined by running a single line at the same speed over a flat area in opposite directions (Line C – D in **Figure 2**). A deep roll verification was not performed during EX-22-05 to confirm values.
- **Heading Offset** - The heading bias was determined by running a pair of parallel lines at the same speed and direction, offset from each other (Line E – F and G – H in **Figure 2**).

## POS MV Results

The angular offsets calculated for the POS MV during EX-22-05 are shown below. This patch test (with the POS MV set as the primary system) showed less bias in pitch and heading than determined by the patch test conducted during EX-22-01, likely due to an improvement in environmental conditions (sea state and sound speed). The EX-22-05 values were applied to SIS for Attitude 2 on July 10, 2022.

**Table 1.** Angular offsets calculated for POS MV (Attitude 2) during EX-22-05.

	EX-22-01	EX-22-05* added to SIS
Pitch	-0.12°	-0.05°
Roll	0°	0°
Heading	+0.15°	0°

## Seapath Results

The angular offsets calculated for the Seapath during EX-22-05 are shown below. This patch test (with the POS MV set as the primary system) showed less bias in roll and heading than determined by the patch test conducted during EX-22-01, also likely due to an improvement in environmental conditions (sea state and sound speed). The EX-22-05 values were applied to SIS for Attitude 1 on July 23, 2022.

**Table 2.** Angular offsets calculated for Seapath (Attitude 1) during EX-22-05.

	EX-22-01	EX-22-05 added to SIS
Pitch	-0.1°	-0.1°
Roll	-0.02°	0°
Heading	0°	0°